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patient supposes himself affected with a disease of which no external symptoms appear.

Chronic disorders of the liver and bowels appear to the writer to be much more frequent among the higher classes than among the other—a torpid state of the bowels and a vitiated secretion of the liver form indeed the constant plague of thousands in the higher orders. This may be attributed partly to inactive life, and partly to high seasoned food, and the constant use of wine or punch, which are peculiarly injurious to the hepatic system—the occasional intoxications of the poor, are not in the writer's opinion, near so injurious to the stomach and liver, as the constant and daily use of punch or wine, though taken in moderate quantity.

On the other hand acute diseases of every description are much more prevalent among the poor: contagious fever in particular, which is comparatively rare among the rich, is the great destroyer of the poor; and this fact affords an unanswerable argument in favour of cleanliness, which assuredly is the chief preserver of the rich. J. O'B.

25, Stephen-Street.

January 30th, 1812.

To the Proprietors of the Belfast Magazine.

GENTLEMEN,

HAVING observed in your Magazine for February last, an account of an ingenious Optical experiment, which the author, J. S., in a very handsome manner recommends to my consideration, I have accordingly repeated the experiment, and find the results perfectly conformable to his account thereof.

It certainly appears not a little extraordinary, that a feather should produce on the rays of light passing through it, the same phenomena as a multiplying glass cut into a number of facets; with this difference only, that the former separates the rays of which the spectrums are composed, into the prismatic colours, whereas the latter does not.

I apprehend, however, that a satisfactory solution of the phenomena may be found in that law of physical optics, by which the rays of light, in passing within certain minute distances of all solid opaque bodies, are *deflected* or bent out of the line of their motion, *from* such bodies, and at different angles, according to their different degrees of *deflexibility*, and are consequently separated into the prismatic colours, similar to what takes place on their passage through a prism.

If the Sun's rays are admitted into a darkened room, through a circular hole of $\frac{1}{10}$ of an inch diameter, made in a thin plate of lead; and if at 2 or 3 feet distance from the hole, the rays are again transmitted through a narrow aperture of the $\frac{1}{100}$ part of an inch wide, formed by two very straight and smooth knife edges of iron or steel, and blackened with ink to prevent all reflection: and if those rays are received on a sheet of white paper, from 6 to 12 inches behind the aperture, this beam of light passing through it, will, at each side of the direct light, be separated into four beautiful fringes, the colours of each fringe being arranged in the usual order—beginning with violet, next the direct light; then indigo blue, green, yellow, orange, and lastly, red.*

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* This experiment was made by Sir Isaac Newton, who mentions *Grimaldi*, as having discovered that the Sun's rays are separated into coloured fringes in passing through a very narrow aperture. He also says, "By looking on the Sun, through a feather or black-riband, held close to the eye, several rainbows will appear." But there are several phenomena of these experiments

Now each of those fringes may be considered as a separate image of that part of the Sun's disk, from which the pencil of rays proceed which form those fringes; only decomposed into the prismatic colours, in their passage by those knife edges. Such a feather as the author, J.S., describes on examination by a microscope, is found to consist of an immense number of small apertures, formed by the fine fibres of the feather, the extreme minuteness and regularity of which, would far surpass the utmost effort of human art to imitate.

Almost any feather, even that of a

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which had escaped the observation of Newton. One of these may perhaps lead to important consequences.—Namely, that a band of condensed light surrounds the shadows of all opaque bodies held in the Sun's rays, that beyond this focus of condensed light, the rays are separated into faintly coloured right lined fringes, if the edge of the shadow is straight, or turned into rings, if the hole is circular through which the Sun's rays are admitted. This condensation of the Sun's rays seems to be the consequence of their being repelled very near the body, and attracted at a greater distance therefrom; and that those faintly coloured fringes are caused by the rays being drawn towards the body, out of their straight course into this band of condensed light, and thereby leaving faint shadows in their stead. This appearance takes place when the aperture, whether oblong or round, is even greater than $\frac{1}{10}$ of an inch wide; whereas the Newtonian fringes do not appear, until the aperture is reduced to the $\frac{1}{100}$ part of an inch; when the former have entirely diappeared.* The effect of this inflection of the rays towards the body, may be perceived, and the reality of the principle itself, at the same time corroborated, by an easy experiment. Take the glasses out of a common telescope of 12 inches long, put a thin piece of tea chest lead in the place of the object glass; through which a small hole is made, of $\frac{1}{25}$ of an inch diameter; if the full Moon is viewed through this small hole, by one eye applied close to the end of the telescope, when the hole is about half an inch from the eye, while the other eye sees the Moon without the tube of the telescope; in this case two images of the Moon will be perceived, but that seen through the small hole will be less in diameter by about $\frac{1}{5}$, than that seen by the other eye without the tube; it will also be less enlightened, because fewer rays can enter the pupil. This effect is exactly similar to an object being viewed through a concave lens; and cannot be explained on any other principle, than that of the rays coming from the extreme parts of the object being bent out of their straight course, and rendered more diverging, than when viewed by the naked eye.

That diminution of the apparent magnitude of the horizontal Moon, which takes place on its being viewed through a narrow tube, has been adduced as a proof that the phenomenon is owing to imagination alone; but the above experiment seems to prove the contrary, for the effect will be the same, whether the moon is in the horizon, or at its greatest altitude.

Quere.—May not this inflexion of the rays of light in some circumstances affect the magnifying power of telescopes? But to return: it appears that Newton had not pursued these experiments as far as was necessary to satisfy himself. His words are, "When I made the foregoing observations, I designed to repeat most of them with more care and exactness, and to make some new ones, for determining the manner how the rays of light are bent in their passage by bodies, for making the fringes of colours with the dark lines between them. But I was then interrupted, and cannot now think of taking these things into farther consideration. And since I have not finished this part of my design, I shall conclude with proposing only some queries, in order to a farther search to be made by others."—*See Newton's Optics, pages* 292, 297, *and* 313.

* *There are strong reasons for supposing, that those secondary fringes are the true cause of those curious concentric rings, first discoverd by Newton; and which he has so truly and accurately described at page* 264 *of his Optics; and which Dr. Herschell has ascribed to the effects of hair-powder, scattered in the Sun beam! although it appears the experiment had not been made conformable to Newton's directions.*

See Philosophical Transactions, vol. 95, *part* 2*d, pag.* 231.

Fig 1

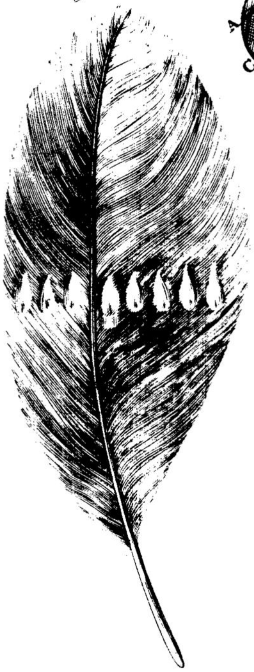


Fig 2

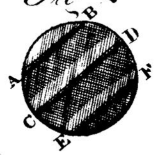


Fig 3

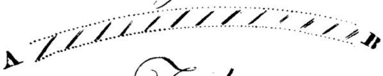


Fig 4

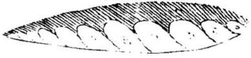
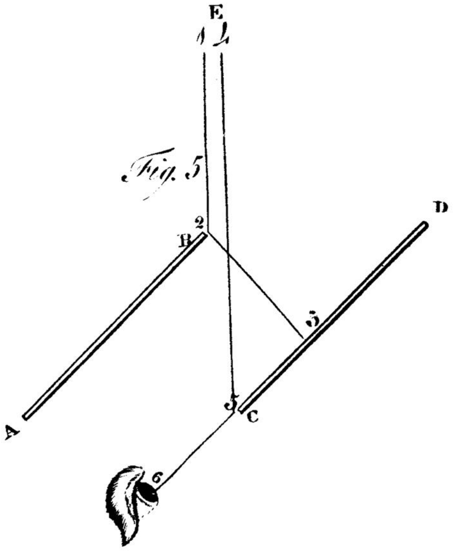


Fig. 5



common goose-quill, will produce in some degree those spectrums; but those of the finest fibres, and pretty close texture, are the fittest for the purpose. Fig. 1. represents the appearance of a range of spectrums produced by the flame of a candle, when viewed through a widgeon's feather; and Fig. 2 is a magnified representation of part of the same feather as it appeared in the field of view of the microscope, through a round hole of $\frac{1}{30}$ of an inch diameter, made in a thin plate of lead, laid on the feather, supposed in the same position as fig. 1st. AB, CD, and EF, are the larger fibres, branching out from the quill at an angle of about 45 degrees, and the smaller fibres branch out from the larger at the same angle. On the upper side next the point of the feather, of each of those stems, the fine fibres reach to the next adjoining stem; but on the lower side they extend only about two-thirds of that distance, leaving one-third of the whole space where the fibres are single; in the other two-thirds they are crossed and interwove into each other like a fine web, as represented in the figure.

The diameter of this small, hole, of $\frac{1}{30}$ of an inch, contained 30 of the fine fibres; 30×30 gives 900 for the number contained in an inch; but as they formed an angle of 45 degrees, with the stem, which measured the diameter of the hole, and on which the fibres were numbered; it is evident a greater number of fibres would be necessary to occupy the same space, if they stood at right angles to the stem, the distance between each remaining the same; for the true measure of the distance between each fibre must be taken at right angles thereto. Therefore, to find the true number of those fine fibres to an inch, 900 must be encreased in the ratio of the side of a square to its diagonal; that is as one to the square root of two, or as 1 to 1,42, nearly which gives 1218 fibres to an inch. And since each pencil of rays which pass through those narrow interstices, are divided into two parts, and each of these again into four; that pencil of rays forming the innermost fringe on each side, and containing all the colours of the prismatic spectrum, must pass the fibre at a distance not exceeding the $\frac{1}{9744}$ part of an inch!

That the coloured spectrums produced by a feather, are caused by the same principle that produce fringes in the Newtonian experiment, is rendered highly probable, for the following reasons.

1st. The number of spectrums seen in the one, always corresponds exactly to the number of fringes seen in the other; therefore, if they do not both proceed from the same principle, their causes must be connected by some intermediate link.

2d. The principal row of spectrums are always arranged at right angles, to the direction of the open or single fibres, because they transmit most light.

3d. A few spectrums of inferior intensity are arranged at right angles to the former, because produced by those fibres that are interwove with others, and therefore transmit less light than the open fibres.

4. If a very thin feather is used, the direct light of the candle is plainly seen, and is *most* intense, when the coloured spectrums are *least* so; because the more rays that pass directly to the eye, the fewer must be deflected.

5. If a feather of a very close texture is used, the direct light of the candle is scarcely perceptible; but the coloured spectrums are then most intense; because few rays pass to the eye, without being deflected.

6. The red side of each spectrum is turned from the direct light, the same as the fringes appear in the

Newtonian experiment; and contrary to what takes place when a luminious object is seen through a prism; for in the latter case, the red side of the spectrum is turned *towards* the direct light; because the colours of the former are produced by deflection of the rays *from* the perpendicular, and in the latter case by refraction *towards* the perpendicular.

7. If a thin feather is used in the experiment, coloured spectrums will appear on each side of the direct light of the candle, although all are seen on the same side of the quill. But if the feather is of a closer texture, the spectrums will appear on one side only of the direct light; namely, that side towards the edge of the feather.

The same result will take place, if the Sun's rays are transmitted through the same feather, by means of a small hole of $\frac{1}{20}$ of an inch wide, made in the window-shutter of a darkened room, and received on a sheet of white paper, for in this case coloured spectrums will be seen on one side only of the direct light.

This result may be explained by a more minute examination of the texture of such a feather, with a higher magnifying power than was used in the first experiment, expressed in fig. 2. In this case, the fibres of the same feather appear to be composed of beautiful thin polished *laminae*, that overlap each other nearly half their breadths; a section of which, by a plane at right angles to the surface of the feather, is represented by AB in fig. 3d. A representation of a single one of those *lumina*, still more highly magnified, is seen in fig. 4th. The small branches at the top, like the tendrils of a vine, are interwoven into the adjoining fibres.

Let AB, and CD, in fig. 5th, represent a section of two of those *laminae*, and let 1, 2, 3, and 4, 5, 6, be two rays of light, issuing from the luminous object at A, and falling on the convex side of the feather. The ray, 1, 2, 3, being nearest to the edge of the fibre, will be deflected from the point 2 to 3, will there be intercepted, or reflected back in such manner as it cannot reach the eye. The other ray, 4, 5, 6, passing at a greater distance from B, will arrive at C, and will there be deflected to the eye at 6. Therefore, in this case, those rays can be seen only on one side of the direct light.

8. Lastly, as the coloured spectrums depend on the position and arrangement of the fibres; their circular motion is a necessary consequence of the circular motion of the feather.

To the above theory it may be objected; that even supposing 8 coloured fringes produced by each interstice of the feather; considering their extreme minuteness and regularity: what should prevent those prismatic colours from being again so completely mixed, as to reduce them in appearance to their original white colour; since it is known, that fine powder composed of all the prismatic colours, and mixed in due proportion, would produce white?

This objection is plausible; and it is certain, that no reasoning *a priore*, could have led to the conclusion, that 8 spectrums only should be produced by several thousand fringes, merely because 8 fringes are produced by each interstice. But as the results are always alike in the same circumstances, we must conclude, they are not the effect of what we call chance; but must proceed from some permanent cause, and that cause must operate in such a manner, that all those fringes which have the same inclination on passing the narrow interstices, coalesce, and are formed into one spectrum, although issuing from different points of the feather;

and since the fringes have only 4 inclinations, or angles, on each side the direct light, consequently there will be but four spectrums on each side. It would also appear, that the same principle operates with respect to the colours of each particular fringe, which takes place with respect to the fringes themselves;—namely, that those colours of each fringe, which issue from the feather at the same angles, coalesce, and thereby form but one homogeneal colour.

This principle of the coalescence of coloured rays, after separation, will hereafter be more fully proved in the intended publication above alluded to by J.S.; but which would be too intricate for introduction into this essay.

In short, there being so many strong proofs in favour of this hypothesis, and but one solitary objection against it, leaves the probability in its favour so strong, that it seems unreasonable to refuse assent thereto. J. K.

Belfast, March 20th, 1812.

To the Proprietors of the Belfast Magazine.

> Homini imperito nunquam quicquid injustius,
> Qui nisi quod ipse facit, nihil rectum putat.

I AM pleased to find that my reply to your correspondent Y's "remarks" on the Lancasterian system of education has brought from him an acknowledgement that those "remarks" were not dictated by a spirit of hostility to the education of the poor; that the arithmetical and spelling lessons, for so far as they go, are good; that the benefits arising from Lancasterian schools may tend to improvement among the poor—and that Lancaster has made as important a reformation in education as Luther and Calvin did in religion.

So many material points conceded by Y, must tend towards eradicating from the minds of your readers any unfavourable impressions which his former remarks may have left, and greatly raise their opinion of the system.

His apprehensions seem now to be confined to the following points, viz. That the system may receive injury by being called after the name of the inventor: "by making the name of Lancaster superior to the cause of the education of the poor, there is danger of its partisans forming a *Procrustean* standard of opinion;" or that "excess of enthusiasm may make Lancaster or his friends become illiberal towards all that may differ in opinion with them; and extremely testy if the smallest doubts are entertained of his infallibility, or the slightest imperfection noticed in his system."

To remove those apprehensions from the mind of your correspondent, and to quiet his fears on those heads, shall be my endeavour: and as my anxious wish is to convince, not to irritate, though an ardent admirer of the system, I hope my language, or my arguments, will neither appear testy nor illiberal.

The system invented by Lancaster, and now beginning to be very generally practised over the United Kingdom, being different from all other systems of education, certainly requires some distinctive appellation, by which, in either writing or speaking, it may be known from any other. It has not only been customary, but convenient, to call new systems by the names of the inventors:—we have the Copernican system of Astronomy, the Newtonian system of Philosophy, the Linnean system of Botany, and the Lutheran and Calvinistic doctrines in religion, with many others unnecessary to mention.—Wherein, therefore, can